REMARKS

The applicant respectfully requests reconsideration in view of the following remarks. The applicant has amended the claims to overcome the claim objections and 35 U.S.C. 112 rejections. No new matter has been added.

Claims 22, 24, 25, 28, 30 and 40 are objected to because of informalities. Claims 24-25 and 31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 22-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Calundann et al. WO 02/081547 ("WO '547"). Since WO '547 is not in English, the applicant will use the disclosure of U.S. 7,235,320 which is the US national stage application for the discussion of WO '547. Claims 22-44 are rejected under 35 U.S.C. 102(b) as being anticipated by Calundann et al WO 02/088219 ("WO '219"). Since WO '219 is not in English, the applicant will use the disclosure of U.S. 7,384,552 which is the US national stage application for the discussion of WO '219. Claims 22-44 are provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over claims 28-62 of copending Application No. 10/584,965. The applicant respectfully traverses these rejections.

Claim Objection and 35 U.S.C. 112 Rejection

Claims 22, 24, 25, 28, 30 and 40 are objected to because of informalities. Claims 24-25 and 31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The applicant has amended the claims to overcome the claim objections and 35 U.S.C. 112 rejections. For the above reasons, this rejection and objection should be withdrawn.

Rejections Under 35 U.S.C. 102

Claims 22-44 are rejected under 35 U.S.C. 102(b) as being anticipated by WO '547. Claims 22-44 are rejected under 35 U.S.C. 102(b) as being anticipated by WO '219. The applicant believes that the instant invention relates to novel membranes.

However, WO '547 and WO '219 use polyphosphoric Acid (PPA) (see step A) in WO '219 at col. 2, lines 16-23 and see step B) in WO '219 at col. 2, lines 16-23). PPA is a condensed phosphoric acid, also known as orthophosphoric acid or phosphoric(V) acid. The phosphorous atom is in the (V) state (oxidation number), whereas the phosphorous atom in the phosphonic acid is in the (III) state (oxidation number).

Since in both cases the hydrolysis products (treatment in step D), stays in the membrane causing the proton conductivity such membranes are different. Therefore, these rejections should be withdrawn.

The common property of the phosphonic acid group and the phosphoric acid group is that both can serve as electrolyte in high temperature fuel cells (see J. Electrochem. Soc., Vol. 143, Issue 9, pages 2765-2770 (1996). In the abstract it was discussed:

"the performance with bis-phosphonic acid was not as good as with phosphoric acid at 100 ^{0}C. ... As the temperature was reaised from 100 to 200 ^{0}C, the cathode performance improved with the phosphonic acid electrolyte."

Therefore, the phosphonic acid group and the phosphoric acid group could be considered similar and therefore one could replace the phosphoric acid group by the phosphonic acid group. This may also be an argument against an obviousness of the instant invention, however, by replacing the phosphoric acid group by the phosphonic acid group not only a further alternative is provided but there is an unexpected improvement achieved.

The hydrolysis product of the organic phosphonic acid anhydride (which is organic phosphonic acid) as well as any remainder organic phosphonic acid anhydride result in an unexpected reduction in the overvoltage, in particular at the cathode side of an MEA (membrane electrode assembly), hence the product is improved over WO '547 and WO '219.

The applicant has informed the undersigned that the following examples were conducted by the applicant (see Appendix 1). The experiments compared an example according to the instant invention (example 1) and an example (example 2) in accordance to the closest prior art.

As can be seen, the proton conductivity of the membrane according to the instant invention is improved, while the oxygen overpotential is reduced. These findings are unexpected and not foreseeable. Therefore, the invention is not obvious over the prior art.

Again, the claimed invention differs from WO '547 and WO '219 in that an organic phosphonic acid anhydride is used instead of the PPA.

As explained above, the hydrolysis product of the organic phosphonic acid anhydride (which is organic phosphonic acid) as well as any remainder organic phosphonic acid anhydride result in an unexpected reduction in the overvoltage, in particular at the cathode side of an MEA (membrane electrode assembly), hence the product is improved over WO '547 and WO '219 and therefore the claims are not obvious over WO '547 and WO '219.

Double Patenting

Claims 22-44 are provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over claims 28-62 of copending Application No. 10/584,965. In response, Applicants have filed herewith a Terminal Disclaimer. Accordingly, Applicants respectfully request that the double-patenting rejection be withdrawn.

The filing of a Terminal Disclaimer to obviate a rejection based on nonstatutory double patenting is not an admission of the propriety of the rejection. The "filing of a Terminal Disclaimer simply serves the statutory function of removing the rejection of double patenting, and raises neither a presumption nor estoppel on the merits of the rejection." Quad Environmental Technologies Corp. v. Union Sanitary District, 946 F.2d 870, 20 U.S.P.Q.2d 1392 (Fed. Cir. 1991). Accordingly, Applicants filing of the attached disclaimer is provided for facilitating a timely resolution to prosecution only, and should not be interpreted as an admission

as to the merits of the obviated rejection. For the above reasons, this rejection should be withdrawn.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 15588-00025-US from which the undersigned is authorized to draw.

Dated: December 21, 2011

Respectfully submitted,

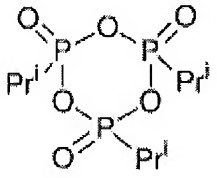
Electronic signature: /Ashley I. Pezzner/
Ashley I. Pezzner
Registration No.: 35,646
CONNOLLY BOVE LODGE & HUTZ LLP
1007 North Orange Street
P. O. Box 2207
Wilmington, Delaware 19899-2207
(302) 658-9141
(302) 658-5614 (Fax)
Attorney for Applicant

APPENDIX 1

Experimental tests

Example 1

60 g of Poly(2,2'-(*m*-phenylene)-5,5'-bibenzimidazole (PBI) polymer was dissolved in 530 g of 2-propane phosphonic acid anhydride (T3P, example formula 1) in a three-necked flask provided with a mechanical stirrer and N_2 inlet and outlet. The mixture is heated to 220°C for 4 hours. A thin film of the mixture is cast onto a glass plate. Finally, the film hydrolyzing occurs at 30°C and 65% relative humidity until it solidifies and can be removed from the support material. In this step both the 2-propane phosphonic acid anhydride has been hydrolyzed. A transparent, dark brown self-supporting polymer film was obtained.



Example formula 1

Example 2:

60 g of Poly(2,2'-(*m*-phenylene)-5,5'-bibenzimidazole (PBI) polymer was dissolved in 530 g of polyphosphoric acid in a three-necked flask provided with a mechanical stirrer and N_2 inlet and outlet. The dispersion is heated to 220°C for 4 hours. A thin film of the dispersion is cast onto a glass plate. Finally, the film hydrolyzing occurs at 30°C and 65% relative humidity until it solidifies and can be removed from the support material. In this step the polyphosphoric acid has been hydrolyzed. A transparent, dark brown self-supporting polymer film was obtained.

Example 3:

Proton conductivity measurements are carried out at 160°C using a standard 4-electrode setup using AC impedance spectroscopy under unhumidifed conditions. A comparison of proton conductivities of membranes from example 1 and 2, respectively, have been measured.

Proton conductivity Example 1 membrane: 195mS/cm
Proton conductivity Example 2 membrane; 175mS/cm

Example 4:

Cathodic overpotentials have been determined for the oxygen reduction reaction at 160°C in a 50cm² fuel cell with hydrogen and oxygen as anodic and cathodic gases, respectively. Anodes and cathodes have been commercial electrodes from Etek with 1mg/cm² loading of Pt as catalysts. Oxygen overpotentials where obtained from the difference of the equilibrium potential under the measured conditions and the ohmic resistance corrected polarization data at 0.1A/cm².

Oxygen overpotential fuel cell with Example 1 membrane: 0.405 V
Oxygen overpotential fuel cell with Example 2 membrane: 0.419 V